

Instructions (shown before students start the test)



- The rules for this event have been adapted for our virtual tournament and follow the **2020-2021 Regional Rules**.
- For fill-in-the-blank questions, the capitalization of the answers (e.g. Answer vs. answer) will **NOT** be considered (i.e. both answers will be accepted). However, incorrect spelling and unnecessary spaces before/after the answers will lead to an incorrect answer. Keep this in mind!
- For multiple-choice questions with multiple answers, it's ALL or NOTHING - *there's no partial credit!*
- The maximum number of obtainable points on this exam is **126**.
- Leaving the test window is **NOT** acceptable - time outside the browser *will* be monitored by Scilympiad!!
- If you have any questions or concerns regarding this exam, feel free to contact me through the following email once the testing window has concluded: shrayenpatel@utexas.edu
- Exam Author: Shraven Patel, *The University of Texas at Austin, B.S. Biology '24*
- Per Texas Science Olympiad rules, you must have printed notes for this event. If you are communicating with your partner through a voice or video call, please start it before you begin the test itself.
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1. (1.00 pts) Community water _____ prevents tooth decay both effectively & safely!

2. (1.00 pts) Direct potable water reuse involves some sort of environmental buffer (ex. river) prior to water treatment.

True False

3. (1.00 pts) National Primary Drinking Water Regulations undergo review every ___ years. (**enter an integer ONLY**)

4. (4.00 pts) According to the EPA, which of the following processes accomplish the water treatment objective of removing suspended solids?

(Mark **ALL** correct answers)

- A) Coagulation
- B) Flocculation
- C) Sedimentation
- D) Electrodialysis
- E) Ultraviolet Disinfection
- F) Microfiltration

5. (4.00 pts) According to the EPA, which of the following processes accomplish the water treatment objective of disinfecting & removing trace organic compounds?

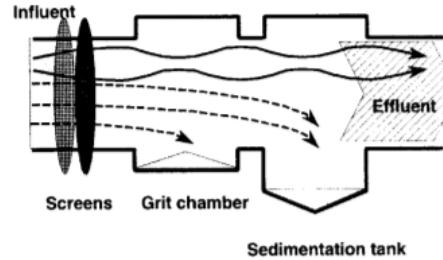
(Mark ALL correct answers)

- A) Sedimentation
- B) Ultrafiltration
- C) Reverse Osmosis
- D) Nanofiltration
- E) Ultraviolet Disinfection
- F) Pasteurization

6. (1.00 pts) Blending groundwater with surface water is a technique often used to improve water quality prior to treatment.

- True
- False

7. (1.00 pts) Which step of the wastewater treatment process is depicted in the diagram below?



- A) Primary
- B) Secondary
- C) Tertiary

8. (3.00 pts) Why are grit chambers especially important in water treatment networks in coastal regions, such as Florida and Hawaii?

9. (1.00 pts) Chlorination can kill more than ___ % of harmful bacteria in a stream of effluent. (**enter an integer ONLY**)

10. (2.00 pts) How can wastewater be used to track COVID-19?

11. (1.00 pts) A single severe event (ex. hurricane) can dramatically affect an estuary.

- True
- False

12. (3.00 pts) Which of the following are TRUE regarding the importance of estuaries?

(Mark ALL correct answers)

- A) Humans widely use estuaries for recreational activities such as boating and fishing

- B) Estuaries protect human communities against flooding and help mitigate storm surges
- C) Wastewater treatment facilities play little to no impact on estuarine water quality
- D) Estuaries are dynamic ecosystems that incorporate diverse habitats

13. (1.00 pts) Over __ % of the world's coral reefs have died in the past 30 years. (**enter an integer ONLY**)

14. (3.00 pts) What are 2 modes of asexual coral reproduction?

15. (6.00 pts) What are 2 modes of sexual coral reproduction? What is a major difference between the larvae produced from each of these two sexual reproductive methods?

16. (1.00 pts) Most coral species are gonochoric.

- True
- False

17. (1.00 pts) Some beaches turn what color from gametes washed ashore after a night of coral spawning?

- A) Red
- B) Orange
- C) Yellow
- D) Green
- E) Blue
- F) Purple

18. (1.00 pts) A harmful algal bloom can look like foam on surfaces of water bodies when viewed from above.

- True
- False

19. (3.00 pts) Which of the following are toxins produced from harmful algal blooms?

(Mark **ALL** correct answers)

- A) Azaspiracid
- B) Bufotoxin
- C) Dioxin
- D) Domoic acid
- E) Saxitoxin
- F) Ricin

20. (1.00 pts) Harmful algal blooms are more likely to occur in rapid-moving water than slow-moving water, disregarding the other factors necessary for one to occur.

- True
- False

21. (1.00 pts) Dogs are more susceptible than humans to poisoning from a harmful algal bloom.

- True False

22. (1.00 pts) Which bond prevents per- and polyfluorinated alkyl (PFAS) chemicals from degrading in the environment?

- A) Carbon-hydrogen
- B) Carbon-chlorine
- C) Carbon-carbon
- D) Carbon-fluorine

23. (4.00 pts) Based on their chemical structure as pictured below, which of the following are categorized as PFAS chemicals?

A: B: C:
D: E: F:

(Mark **ALL** correct answers)

- A) A
- B) B
- C) C
- D) D
- E) E
- F) F

24. (1.00 pts) PFAS chemicals repel oil and water.

- True False

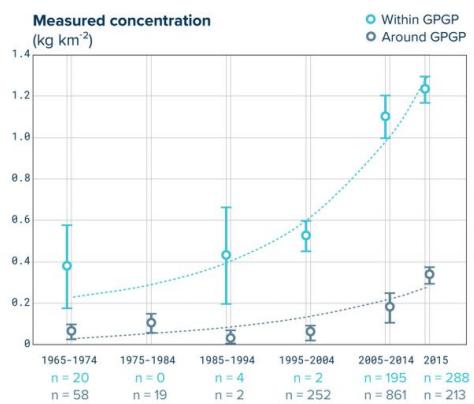
25. (1.00 pts) PFAS chemicals have relatively short half-lives.

- True False

26. (1.00 pts) Most of the "garbage" in the five ocean garbage patches consists of what?

- A) Fishing gear
- B) Water bottles
- C) Micro-plastics
- D) Bags
- E) Wrappers

27. (1.00 pts) Based on the diagram below, how has the concentration of waste in the Great Pacific Garbage Patch changed over time?



- A) Decreased
- B) Remained constant
- C) Increased

Use the following image for the next FIVE questions (28-32):



28. (1.00 pts) What is the common name of organism A? (enter exactly as printed in the rules manual, with NO spaces in between words if applicable)

29. (1.00 pts) Most members of organism A are _____ hermaphrodites.

30. (1.00 pts) Members of organism A can grow up to ___ pounds. (enter an integer ONLY)

31. (1.00 pts) Members of organism A tend to live in groups with a ratio of about 4-14 females to 1 male.

- True
- False

32. (1.00 pts) Members of organism A cannot change skin color(s) to blend in with their environment.

- True
- False

Use the following image for the next SEVEN questions (33-39):



33. (1.00 pts) What is the common name of organism B?

- A) Banded coral shrimp
- B) Sponge
- C) Lobster
- D) Moray eel

34. (1.00 pts) Members of organism B have __ sets of jaws. (enter an integer ONLY)

35. (1.00 pts) Referring back to the previous question, these specific jaws are called _____ jaws.

36. (1.00 pts) Most members of organism B are diurnal.

- True
- False

37. (4.00 pts) Members of organism B have one apparent long, single, unbroken structure merging what three fins together?

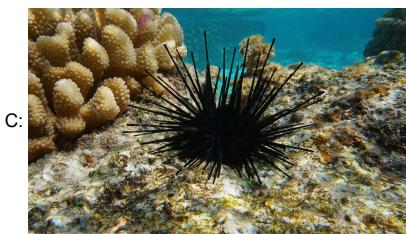
38. (1.00 pts) Members of organism B have strong night vision.

- True
- False

39. (1.00 pts) Members of organism B are currently listed as endangered on the IUCN Red List of Threatened Species.

- True
- False

Use the following image for the next SIX questions (40-45):



40. (1.00 pts) Organism C is a pencil urchin.

- True False

41. (2.00 pts) Why are members of organism C vital to the health & survival of coral reefs?

42. (2.00 pts) How do members of organism C ensure eggs and sperm are released in the water at the same time to facilitate reproduction?

43. (1.00 pts) Members of organism C are currently listed as endangered on the IUCN Red List of Threatened Species.

- True False

44. (1.00 pts) At one point in history, almost 90% of members of organism C died off.

- True False

45. (1.00 pts) The spines on members of organism C usually grow up to how many centimeters?

- A) 1-3
- B) 4-6
- C) 7-9
- D) 10-12
- E) 13-15
- F) 16-18

Use the following image for the next FOUR questions (46-49):



D:

46. (1.00 pts) What is the common name of organism D? (enter exactly as printed in the rules manual, with NO spaces in between words if applicable)

47. (2.00 pts) How do members of organism D prepare their prey for consumption?

48. (3.00 pts) Which of the following are preyed on by members of organism D?

(Mark ALL correct answers)

- A) Crown of thorns starfish
- B) Sea cucumbers
- C) Snappers
- D) Bumphead parrotfish
- E) Lobsters

49. (1.00 pts) Members of organism D are cold-water predators.

- True
- False

50. (10.00 pts)

For EACH organism from the 2020-2021 Water Quality species list pictured below, identify the organism and its common name (**example format: "M - Lobster"**). If an organism is NOT part of the 2020-2021 Water Quality species list, do NOT name it below, as negative points ARE possible for this question.

You may be asking yourself "why would he do this to us?!" and the answer is: to ensure you're actually able to distinguish between organisms and aren't just guessing from the given list!!



R:



51. (1.00 pts) Temperature has the smallest impact of all analytes on the concentration of dissolved oxygen in a sample of water.

- True False

52. (5.00 pts) Which of the following have a DIRECT relationship with each other?

(Mark ALL correct answers)

- A) Temperature & phosphates
- B) Temperature & nitrates
- C) Temperature & total dissolved solids
- D) Temperature & biological oxygen demand
- E) Temperature & dissolved oxygen
- F) Temperature & fecal coliform

53. (1.00 pts) Temperature and turbidity have an INVERSE relationship with each other.

- True False

54. (1.00 pts) Temperature and pH have an INVERSE relationship with each other.

- True False

55. (1.00 pts) Sediment is the largest point source pollutant in the United States.

- True False

56. (1.00 pts) A conductivity test is the most accurate test to determine the level of total dissolved solids (TDS) in a sample of water.

- True False

57. (1.00 pts) If the Secchi depth measured is 3 meters, the range of approximate depth that light can penetrate into the body of water is also 3 meters.

- True False

58. (1.00 pts) The scattering light method of detecting turbidity is used for samples of water with an apparent high turbidity.

- True False

59. (10.00 pts) What is/are the difference(s) between the membrane filtration method and multiple-tube fermentation methods of testing for fecal coliform bacteria?

60. (1.00 pts) An aragonite saturation level greater than __ indicates supersaturation. (enter an integer ONLY)

61. (5.00 pts) Based on the diagram below, what is the relationship between carbon dioxide levels and aragonite saturation levels? Explain why.

(Diagram area)

62. (1.00 pts) A _____ measures the concentration of salt in a solution.

(Diagram area)

63. (1.00 pts) A _____ measures the specific gravity of a sample of water.

(Diagram area)

64. (1.00 pts) The standard oxidation/incubation test period for biological oxygen demand (BOD) is 5 days at 20 degrees Celsius (°C).

- True False

65. (1.00 pts) If a sample of water is NOT diluted, its biological oxygen demand (BOD) can be calculated by subtracting its initial dissolved oxygen (DO) level from its final DO level.

- True False

66. (1.00 pts)

To ensure proper biological activity during a BOD test, a sample of water must not contain any _____. (enter the full name of ONE element from the periodic table)

(Diagram area)

67. (1.00 pts) Limestone is a source of natural alkalinity.

- True False

68. (1.00 pts) The hardness of a sample of water depends on the level(s) of which of the following elements in the sample?

- A) Calcium
 B) Magnesium
 C) Both A & B
 D) Neither A & B

69. (1.00 pts) On average, Utah has "harder" water than Alabama.

- True False

Congratulations, you've completed the 2021 UT Austin Regional Water Quality B/C test! Best of luck in your other events, and I hope you enjoyed taking this test today! If you have any feedback about any of the exams at this tournament, please let us know through this form: <https://tinyurl.com/utreg21feedback> (<https://tinyurl.com/utreg21feedback>)

- Shraven Patel (UT '24)

